DOCKET NO: **492P002**

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of: **Daniel A. Daluise** and **Paul R. Lioi**

Serial No.: **Not yet assigned**
Group Art Unit: **Not yet assigned**
Filing Date: **Herewith by Express Mail**
Examiner: **Not yet assigned**

For: **VERTICALLY DRAINING, RUBBER-FILLED SYNTHETIC TURF AND METHOD OF MANUFACTURE**

EXPRESS MAIL LABEL NO.: **EE120116283US**
DATE OF DEPOSIT: **June 1, 1998**

BOX: __X__ Patent Application

____ Provisional ____ Design ____ Sequence

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

PATENT APPLICATION TRANSMITTAL LETTER

Transmitted herewith for filing, please find:

__X__ A Utility Patent Application.

If this is a continuing application, please check appropriate box:

____ Continuation _____ Divisional ___ Continuation-in-part of prior application _____

____ Provisional Application.

____ A Design Patent Application (submitted in duplicate).

DOCKET NO: **492P002**

Including the following:

____ Provisional Application Cover Sheet.

____ New or Revised specification, including pages ___ to ____ containing:

____ Specification

____ Claims

____ Abstract

____ A copy of earlier application Serial No. _____ Filed _____ to which no new matter has been added TOGETHER WITH a copy of the executed oath or declaration for such earlier application and all drawings and appendices. Such earlier application is hereby incorporated into the present application by reference.

____ Please enter the following amendment to the Specification under the Cross Reference to Related Applications section (or create such a section): "**This application is ...**"

____ Signed Statement attached deleting inventor(s) named in the prior application.

____ Preliminary Amendment is enclosed.

__X__ __Two (2)__ Sheets of Drawings.

____ Petition to Accept Photographic Drawings.

____ Petition Fee

__X__ An _____ Executed __X__ Unexecuted Declaration or Oath and Power of Attorney.

____ An Associate Power of Attorney.

____ An Executed Assignment of the Invention to:
_____

_____ A Recordation Form Cover Sheet.

_____ Recording Fee - $40.00.

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____ Priority is claimed under 35 U.S.C. §119 of application Serial No: _____ filed _____ in _____

____ A Certified Copy of the foregoing application for which priority is claimed:

____ is enclosed.

____ will be submitted in due course

____ were filed in prior application Serial No. _____ filed _____ on _____

____ was transmitted by the International Bureau under International Application No. _____ filed _____

____ An _____ Executed _____ Copy of Earlier Statement Claiming Small Entity Status under 37 C.F.R. 1.9 and 1.27

____ is enclosed.

____ has been filed in prior application Serial No. _____ filed _____, said status is still proper and desired in present case.

____ Diskette Containing DNA/Amino Acid Sequence Information.

____ Statement to Support submission of DNA/Amino Acid Sequence Information.

____ Letter of Reference to Computer Readable Form.

____ Information Disclosure Statement.

____ Attached Form 1449.

____ Copies of each of the references listed on the attached Form PTO-1449 are enclosed herewith.

____ Petition for Extension of Time for parent application, Together with the appropriate extension fee.

____ Appended Materials as follows: _____.

__X__ Return Receipt Postcard specifically itemized.

____ Other as follows:

DOCKET NO: **492P002**

FEE CALCULATION **BASIC FEES**

Provisional Application	$150.00
Design Application	$330.00
Utility Application	$790.00

For	Number Filed	Number Extra	Rate	Fee
Basic Fee				$ 790.00
Total Claims	12 - 20	0	x $22.00 =	$ 0.00
Independent Claims	2 - 3	0	x $82.00 =	$ 0.00
Multiple Dependent Claims			+ $270.00 =	$ 0.00
		TOTAL FILING FEES		$ 790.00
		1/2 SMALL ENTITY FEE		**$ 395.00***

***The Filing Fee will be submitted in due course, together with the executed Declaration, Verified Statement Claiming Small Entity Status and the surcharge for late filing.**

____ A Check is enclosed in the amount of _____.

____ The Commissioner is hereby requested to grant an extension of time for the appropriate length of time, should one be necessary, in connection with this filing or any future filing submitted to the U.S. Patent and Trademark Office in the above-identified application during the pendency of this application. The Commissioner is further authorized to charge any fees related to any such extension of time to deposit account _____. This sheet is provided in duplicate.

____ The Commissioner is authorized to charge payment of the following fees and to refund any overpayment associated with this communication or during the pendency of this application to deposit account _____. This sheet is provided in duplicate.

____ The foregoing amount due.

____ Any additional filing fees required, including fees for the presentation of extra claims under 37 C.F.R. 1.16.

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____ Any additional patent application processing fees under 37 C.F.R. 1.17 or 1.20(d).

____ The issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance.

SHOULD ANY DEFICIENCIES APPEAR which respect to this application, including deficiencies in payment of fees, missing parts of the application or otherwise, the United States Patent and Trademark Office is respectfully required to promptly notify the undersigned.

Date: June 1, 1998

Kevin S. Lemack
Registration No. 32,579
Nields, Lemack & Dingman
176 E. Main Street - Suite 8
Westboro, Massachusetts 01581
TEL: (508) 898-1818
FAX: (508) 898-2020

Attorney Docket No. **492P002**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: **Daniel A. Daluise** and **Paul R. Lioi**

For: **VERTICALLY DRAINING, RUBBER-FILLED SYNTHETIC TURF AND METHOD OF MANUFACTURE**

Assistant Commissioner of Patents and Trademarks
Washington, D.C. 20231
Sir:

LETTER

The above-identified applicants enclose for filing a patent application entitled **"VERTICALLY DRAINING, RUBBER-FILLED SYNTHETIC TURF AND METHOD OF MANUFACTURE"**. Said attached patent application includes **(1)** Patent Application Transmittal Letter (5-Pages); **(2)** Patent Application: 11-Page Specification (including 1-Page of Claims (12) and 1-Page Abstract), 2-sheets of 8½x11 size drawings and an unexecuted Combined Declaration and Power of Attorney (1-Page).

All correspondence concerning this application should be mailed to:

Kevin S. Lemack
Nields, Lemack & Dingman
176 E. Main Street - Suite 8
Westboro, Massachusetts 01581

Respectfully submitted,

Kevin S. Lemack
Attorney for Applicant
Registration No. 32,579

Date: June 1, 1998

VERTICALLY DRAINING, RUBBER-FILLED SYNTHETIC TURF AND METHOD OF MANUFACTURE

BACKGROUND OF THE INVENTION

Artificial turf has long been used in athletic venues. It is a general object of such surfaces to mimic natural grass turfs while eliminating the high maintenance required and poor durability of the same. However, much concern has arisen about the propensity for certain types of injury associated with the product. Indeed, grass surfaces provide excellent shock-absorbing properties and excellent traction for athletes as they traverse the turf, yet conventional synthetic turfs tend to fall short in these areas. Moreover, conventional synthetic turfs tend to be abrasive, rendering them inappropriate for such sports as soccer and lacrosse. In addition, unnatural ball action on conventional turfs inhibits play of these and other sports.

More recently, artificial turf filled with a mixture of sand and rubber has been shown to address many of these problems by reducing the potential for certain turf-induced injuries and by greatly reducing abrasion. For example, U.S. Patent No. 4,337,283 discloses an artificial turf comprising a subsurface, a pile fabric having a flexible backing on the subsurface, and a compacted top-dressing layer comprising a mixture of from 25 to 95 volume percent resilient particles such as rubber, and from 5 to 75 volume percent fine sand. The top-dressing layer is interspersed among the pile elements of the pile fabric and on the backing. The purpose of the top-dressing layer is to stabilize the pile elements, prevent graininess (i.e., prevent the tendency of the pile fabric to lay in

a given direction), absorb shock, and improve the footing of a player running or walking across the surface. Although the use of fine sand in the top-dressing layer adds weight and reduces sponginess to the pile fabric layer and is less abrasive than "large" sand, it still suffers from undesirable abrasiveness. In addition, the turf system relies on gravity and the slope of the sub-base for water drainage.

SUMMARY OF THE INVENTION

The problems of the prior art have been overcome by the present invention, which provides a vertically draining synthetic turf having reduced abrasiveness and increased resilience compared to conventional synthetic turfs. The vertical draining system of the present invention prevents water from accumulating on the turf surface, which could cause the top-dressing layer to "float" and be moved by inundation. The draining system of the present invention incorporates a porous geotextile membrane between an open graded aggregate layer and a sand layer above the aggregate layer to prevent the movement of one aggregate layer into the other.

The top-dressing layer of the present invention eliminates the use of sand and its concomitant abrasiveness. The top-dressing layer consists of resilient particles, preferably a mixture of high and low density rubber.

The pile fabric preferably includes a spun-bound, non-woven, isotropic backing which is laminated or otherwise secured to a woven (FLW) backing which is tufted with the felt side facing the

ground and toward the non-woven backing.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a cross-sectional view of the artificial turf in accordance with the present invention;

Figure 2 is a schematic top view of a typical football field drainage system layout in accordance with the present invention; and

Figure 3 is a schematic top view of a typical soccer field drainage system layout in accordance with the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Turning first to Figure 1, there is shown generally at 10 a synthetic turf having a sloped sub-surface base 2 layer. The sub-surface base 2 is formed by removing turf, loam, etc. and grading and compacting the earth. Excavation of materials is as necessary to establish a proper grade of sub-base to a tolerance of about 1" per 10 feet. Preferably the slope of the sub-surface base 2 is 0.5% to about 1% from the field centerline in order to facilitate drainage, and the sub-base is compacted to about 95% Proctor density, if possible, to form a firm and stable surface.

An open graded aggregate layer 3 is disposed over the sub-surface base 2. Preferably the open aggregate layer 3 is comprised of free-draining stone, and the layer has a thickness of about 6 inches. Suitable open graded aggregate is a mixture of sand and stone, and has low fines, preferably under 5% fines of 200 mesh

size. One particular suitable aggregate has the following analysis:

% of Passing	Sieve size
100	1.25"
52-100	3/4"
36-65	3/8"
8-40	#4
0-12	#16
0-5	#200

Preferably the aggregate is installed so as to maintain a finished grade slope of 0.5% or greater toward the edges of the field.

Situated over the entire open graded aggregate layer 3 is a non-woven porous geotextile membrane 4, preferably made of a needle punched polypropylene, such as Amoco 4545 commercially available from Amoco. The membrane 4 is permeable to water but prevents movement of one aggregate layer into the other. Specifically, a porous free-draining layer of sand 5, preferably about 2 inches thick, is placed over the membrane 4, and the membrane 4 functions to prevent the sand layer 5 from intermingling with the aggregate layer 3 below. In the absence of the membrane layer 4, water tends to carry sand from the sand layer 5 into the interstices of the open aggregate layer 3, reducing the porosity of the open aggregate layer, thereby reducing the critical drainage efficiency of the same. In addition, as the sand is carried into the open graded aggregate layer 3, the sand layer develops deleterious depressions (cupping) where the flow of water is concentrated. Preferably the membrane 4 is about 1/8 inches thick.

In order to minimize or eliminate the tendency of the sand layer 5 to compact, resilient particles or granules 16 such as

rubber particles are embedded, mixed or otherwise added to the sand layer 5. Specifically, after the sand layer has been compacted and fine-graded, resilient particles 16 such as rubber granules are applied at a uniform rate to the entire sand layer, such as by drop spreading, spraying, or other pneumatic delivery method. Preferably the amount of rubber granules used is from about 0.2 to about 3 lb/ft^2, most preferably about 1 lb/ft^2. After application, the resilient particles are preferably forced into the sand layer 5 and become embedded therein with a standard compaction roller. The embedded particles helps prevent sand compaction by maintaining particle separation. By preventing compaction, the embedded resilient particles ensure that the sand layer remains open and porous, maintaining drainage efficiency. The embedded resilient particles also enhance the overall shock absorption of the entire system (without a concomitant increase in pile height or infill depth) and prevent a decrease in shock absorption capabilities of the entire system over time. Suitable resilient particles for this purpose include natural rubber, synthetic rubber such as styrene butadiene (ground tire rubber), butyl rubber, neoprene, urethane rubber, nitrile rubber, etc.

The playing surface 1 includes a pile fabric 9 of individual tufted yarn or yarn-like filaments. The material used for the yarn filaments is not particularly limited, and can include polypropylene or polyethylene, or preferably a polyethylene/polypropylene blend yarn, or other suitable yarn material. A blend of 80% polyethylene and 20% polypropylene yarn

is preferred due to its low abrasiveness and its grass-like appearance. Tufting through the backing at a yarn density of about 10 to 60 oz/yd^2, preferably about 20-30 oz/yd^2, so that the yarn is upstanding and substantially uniform in height, can be carried out to provide a higher weight playing surface.

The fabric backing layer 7 is preferably a heavy weight polymeric coated backing to provide additional weight and stability. The backing preferably incorporates a polyester/nylon blend, spun-bound, non-woven material which provides exceptional dimensional stability, thus preventing wrinkling. This non-woven backing is preferably bonded to the standard woven backing, known in the art as "FLW", which includes a layer of felt. Conventionally, the felt layer is positioned so that it faces upward. However, in accordance with a preferred embodiment of the present invention, the felt layer is oriented toward the ground, thereby facing downward toward the non-woven backing layer. The spun-bonded non-woven backing is made of absorbent polymers such as nylon and polyester which absorb the liquid-applied secondary backing, such as a urethane or styrene butadiene typically used in a carpet coating process. The liquid-applied secondary backing can be applied by spray coating, and helps bond the yarn tufts and add strength and stiffness to the carpet. The non-woven material also has the advantage of being very open in its physical construction. This feature, combined with the highly absorbent nature of the felt side of the FLW primary backing, creates a double backing which can absorb much higher weights of carpet coating polymers. As a

result, the product has sufficient weight and dimensional stability to preclude the possibility of wrinkling or other movement due to thermal expansion and contraction or impact loading.

The entire double backing is preferably perforated with holes 2" to 8" apart to allow for vertical drainage, with 4" average separation being especially preferred. Suitable hole diameters include diameters ranging from about 0.1" to about 0.75", with 0.25"-0.5" being preferred. The hole size can vary from hole to hole.

The top-coating or infill layer 6 is devoid of sand and its concomitant abrasiveness. It is composed entirely of resilient material, preferably rubber, including natural rubber, synthetic rubber such as styrene butadiene (ground tire rubber), butyl rubber, neoprene, urethane rubber, nitrile rubber, etc. Preferably a blend of ground tire rubber and high density rubber is used, with the preferred amount of high density rubber being about 75-80% of the mix. The depth of the infill should be substantially uniform and between about 0.5 inches and 1.75 inches, and is preferably about 1.5 inches in the case where the pile height is 2". Typically the infill should be between 3/4" and 1/2" below the full pile height.

An interior perimeter drainage system is used to assist in water drainage from the field, as illustrated in Figures 2 and 3. Preferably the system comprises a 1" x 18" TRAX FLOW II prefabricated drain line 30 running along the interior edge of the track surface. The drain line 30 is a length of perforated,

interconnected pipe and snap-on couplings and outlets made of high density polyethylene. A 3-4" wide trench is excavated such as with a rotary trencher to a sufficient depth to allow for the depth of the prefabricated drain plus an additional 2". The bottom of the trench should be consistent in elevation, with no deviation of more than 0.5 inches in ten feet. The drain line 30 is then placed in the trench and backfilled with fine aggregate 35 (e.g., concrete sand) meeting the following particle size specifications (ASTM C-33 fine aggregate standard):

25% coarse (2.0 mm to 5.0 mm)

50% medium (0.5 mm to 2.0 mm)

25% fine (0.025 mm to 0.5 mm)

No more than 5% of the total should be smaller than #200 sieve size. The sand backfill can be placed up to the surface or geotextile membrane. The remaining amount of open graded aggregate 5 is then installed over the underdrain system as shown in Figure 1 and is compacted.

These lines 30 may be in communication with existing interior catch basins via appropriate connectors, although no catch basins need by used. An optional 1" x 18" drain line may be installed approximately four feet inside the first line on each straightaway and connected to existing catch basins or by appropriate connectors to the common outflow pipe. 1" x 6" underdrain lines are in communication with the inside drain lines and are arrayed in a typical herringbone design 5' to 30' on center, with 20' on center being the most preferable arrangement.

What is claimed is:

1. A synthetic turf comprising:

a sub-surface layer;

a porous aggregate layer on said sub-surface layer;

a geotextile membrane on said aggregate layer;

a substantially non-compactable layer comprising sand and resilient material on said geotextile membrane;

a pile fabric on said substantially non-compactable layer, said pile fabric comprising a plurality of pile elements secured to a backing; and

an infill for said pile fabric, said infill consisting essentially of resilient particles.

2. The synthetic turf of claim 1, wherein said resilient material in said substantially non-compactable is rubber embedded in said sand.

3. The synthetic turf of claim 1, wherein said resilient particles comprise styrene-butadiene.

4. The synthetic turf of claim 3, wherein said resilient particles further comprise high density rubber.

5. The synthetic turf of claim 1, wherein said pile elements comprise polyethylene.

6. The synthetic turf of claim 1, wherein said backing comprises a non-woven material.

7. The synthetic turf of claim 6, wherein said non-woven material is secured to a woven material having a layer of felt thereon facing said non-woven material.

8. The synthetic turf of claim 1, further comprising drainage means below said pile fabric for directing water away from said turf.

9. The synthetic turf of claim 8, wherein said drainage means comprises a plurality of perforated interconnected pipes.

10. The synthetic turf of claim 9, wherein said drainage means further comprises a plurality of holes in said backing.

11. A method of forming a synthetic turf on a sub-surface base, comprising:

forming a porous aggregate layer on said sub-surface base;

providing a geotextile membrane on said aggregate layer;

forming a substantially non-compactable layer comprising sand and resilient material on said geotextile membrane;

providing a pile fabric on said substantially non-compactable layer, said pile fabric comprising a plurality of pile elements secured to a backing and an infill consisting essentially of resilient particles.

12. The method of claim 11, further comprising providing water drainage by burying a plurality of perforated interconnected pipes below said pile fabric.

ABSTRACT

Vertically draining synthetic turf having reduced abrasiveness and increased resilience compared to conventional synthetic turfs. The vertical draining system of the present invention prevents water from accumulating on the turf surface, which could cause the top-dressing layer to "float" and be moved by inundation. The draining system of the present invention incorporates a porous geotextile membrane between an open graded aggregate layer and a sand layer above the aggregate layer to prevent the movement of one aggregate layer into the other. The top-dressing layer consists of resilient particles, preferably a mixture of high and low density rubber. The pile fabric preferably includes an isotropic non-woven backing to add dimensional stability.

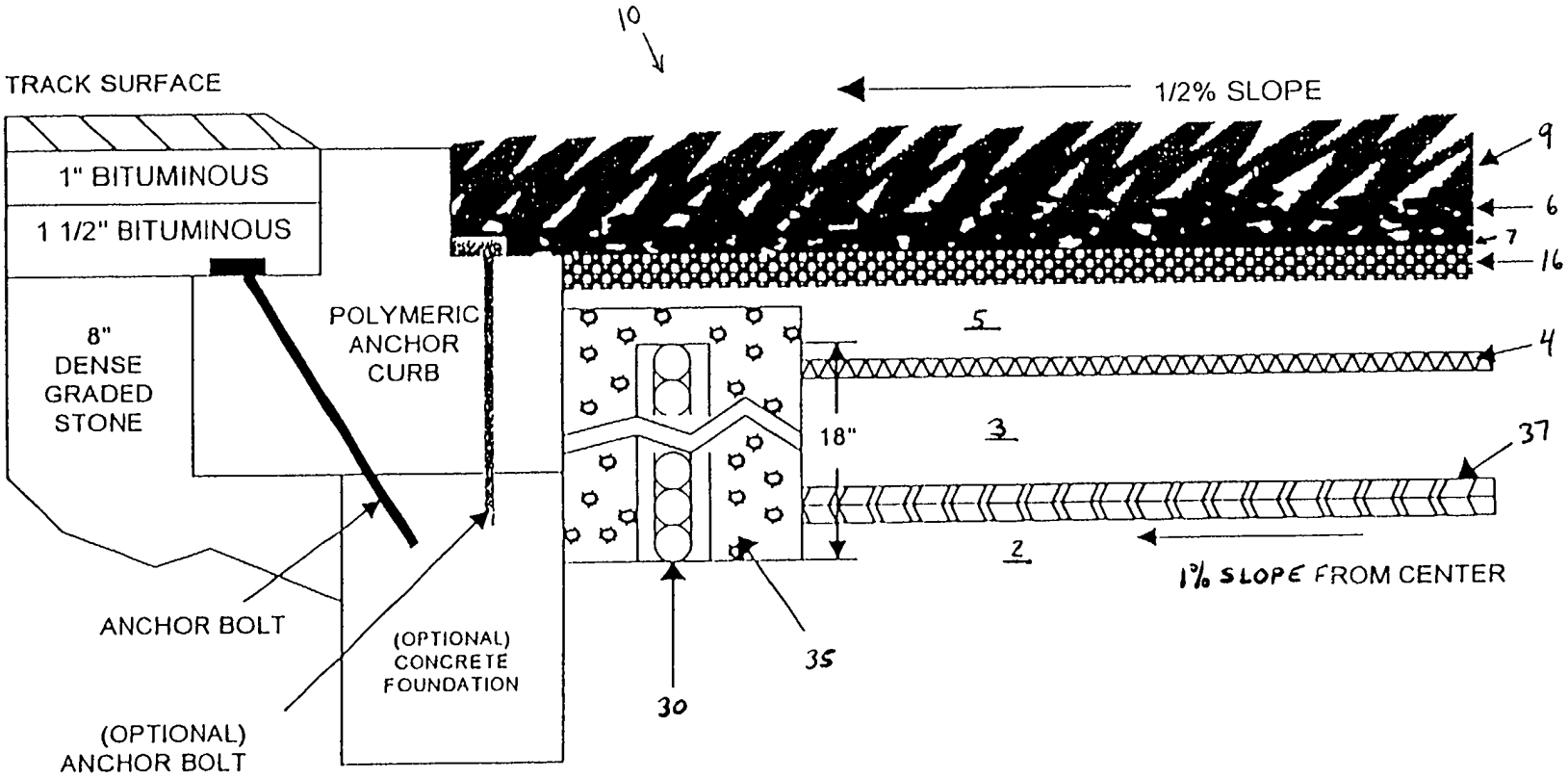

FIG. 1

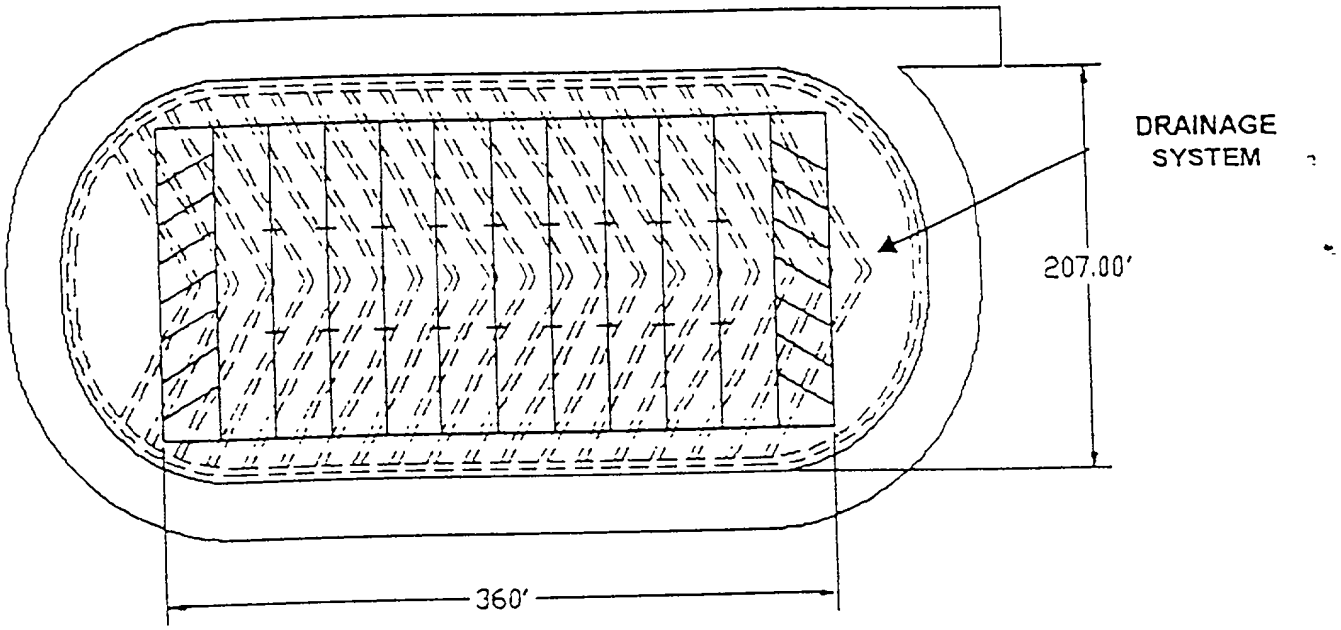

FIG. 2

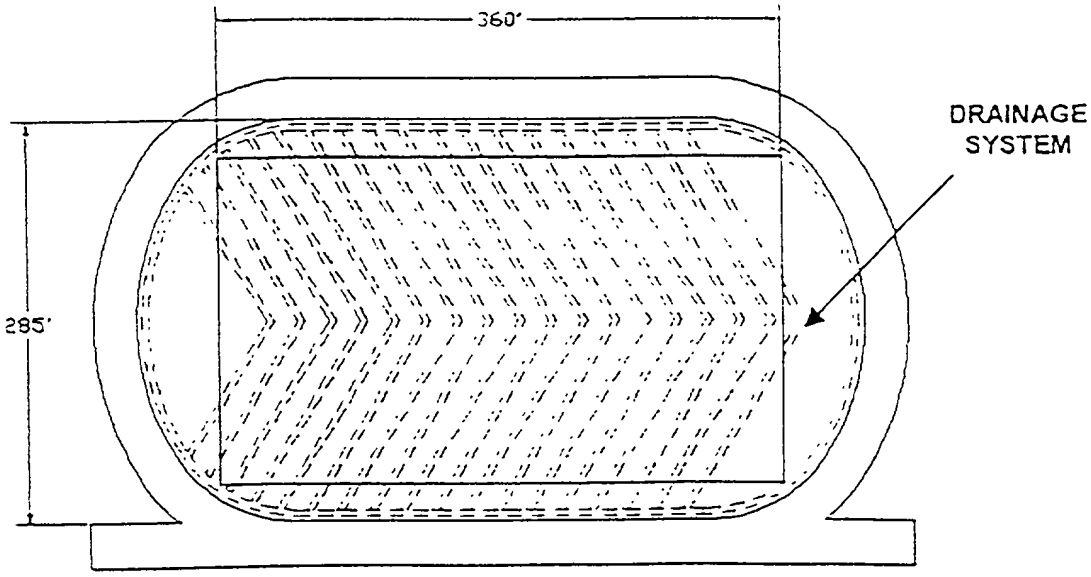

FIG. 3

DECLARATION FOR PATENT APPLICATION

Docket Number (Optional)
492P002

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled VERTICALLY DRAINING, RUBBER-FILLED SYNTHETIC TURF AND METHOD OF MANUFACTURE the specification of which is attached hereto unless the following box is checked:

☐ was filed on _____ as United States Application Number or PCT International Application Number _____ and was amended on _____ (if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s) — Priority Not Claimed

(Number)	(Country)	(Day/Month/Year Filed)	☐
(Number)	(Country)	(Day/Month/Year Filed)	☐

I hereby claim the benefit under 35 U.S.C. § 119(e) of any United States provisional application(s) listed below

(Application Number)	(Filing Date)
(Application Number)	(Filing Date)

I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application

(Application Number)	(Filing Date)	(Status -- patented, pending, abandoned)
(Application Number)	(Filing Date)	(Status -- patented, pending, abandoned)

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith: Kevin S. Lemack, Reg. No. 32,579 Henry C. Nields, Reg. No. 17,029 and Brian M. Dingman, Reg. No. 32,729

Address all telephone calls to Kevin S. Lemack at telephone number (508) 898-1818

Address all correspondence to Kevin S. Lemack
Nields, Lemack & Dingman
176 E. Main Street - Suite 8
Westboro, Massachusetts 01581

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first inventor (given name, family name) Daniel A. Daluise
Inventor's signature _____ Date _____
Residence Southboro, Massachusetts Citizenship U.S.
Post Office Address 11 Skylar Drive, Southboro, Massachusetts 01772

Full name of second joint inventor, if any (given name, family name) Paul R. Lioi
Second Inventor's signature _____ Date _____
Residence Canton, Ohio Citizenship U.S.
Post Office Address 3801 Dave Street, S.W., Canton, Ohio 44706

☐ Additional inventors are being named on separately numbered sheets attached hereto.